Indian Summer IV

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Student Streamside Incubation Project 1998

Dedicated to Autumn Pratt

To this day I can recall,
The best summer I've had of all,
The winding rugged roads,
And all the memories that it holds
Is up to me to be told,
Blue mountains and green trees,
All around a far as the eye can see,
And then the hidden dusk comes crawling in,
The day is almost at the day's end,
Hamburgers and hot dogs on an open grill,
Soon our hunger is fulfilled,
Around the fire everyone gathers,
Laughing and talking seems like for hours,
Rain, lightning and thunder says it's time to rest,
Away in our tents we are nodding off,
The rain and the thunder's story is the last we hear,
We fall asleep but not for long,
Soon the birds awake and sing their morning song,
Then off in the distance I hear "First wake up call'"
And just then a new day filled with freedom starts for all.

Autumn Pratt

Indian Summer IV:
We are all connected

The Shoshone Indians once roamed over vast stretches of mountains and sagebrush-covered plains in what is now Idaho, Utah, Nevada, western Montana, and Wyoming. Theirs was a land of creeks and rivers, hot and cold springs, valleys, and meadows.

The Indians had no written language. Traditions were passed on by the storytellers, men and women trained to teach the children and to amuse everyone. On long winter days, the storyteller gathered the children and adults around a smoky sagebrush fire in a teepee and told them tales of their fathers. In this way generations were connected and ideals were absorbed.

Listen in as we tell one of our stories.

> ***"The birds in the sky and the wind in the grass told us the earth was our gift from the Father and it belongs to all" —*** **Shoshone proverb**

The River

Once in that time long ago, Ejupa, the coyote, decided to go fishing in the country of the Yellowstone. Before he started, he made a huge round fish basket of willows, for the fish were big and plentiful in Yellowstone country. When he finished weaving his willow basket, he lined it carefully with pitch so it would hold water to keep his fish fresh on the journey home.

Off he went carrying the basket on his back. Fishing was good, better than he dreamed it would be. After just one day the coyote had his basket nearly full. Water to keep the fish fresh made his load almost too heavy for Ejupa to carry, but he staggered down the trail, resting whenever he became tired.

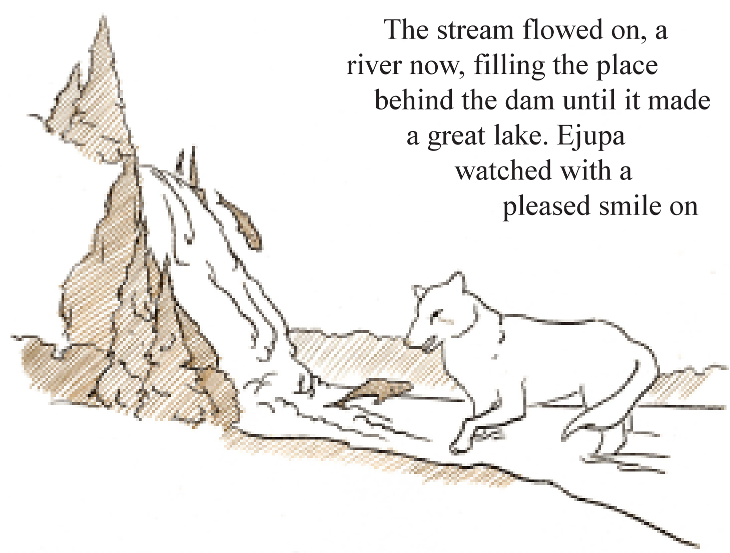
The coyote had gone just a little way when he stumbled over a rock and fell. Swoosh! All the water and all his beautiful fish spilled out onto the ground. The water rushed off downhill with the fish splashing along in it. Ejupa ran after the water, shouting, "Stop, stop! I worked hard to catch those fish. Now, water, you are taking them away." But the water only ran faster.

On and on ran the coyote, but the stream ran faster. It seemed to grow as it bounced and splashed along. Faster and faster it raced, Ejupa strained to match its speed. Finally, he caught up with the rushing stream, but still could do nothing, for he had forgotten his basket.

Then the coyote cut across a little hill and got ahead of the water. He quickly built a rock dam across its path to stop it from running on, but the water kept flowing right over the dam, making a roaring waterfall.

Ejupa watched the water carrying all his beautiful fish and cried out in anger, "I'll stop you yet. Just wait and see!" Then he ran on fast as the wind ahead of the rushing water. He came to another rocky place and built another dam, higher than the last one. "Try to go over this!" he shouted as the water surged toward him.

The stream flowed on, a river now, filling the place behind the dam until it made a great lake. Ejupa watched with a pleased smile on



his face. Then he cried out in horror, “Stop, stop! Please, stop!” Once again the water poured over his rock dam, a thundering waterfall, churning itself white against the boulders. Poor Ejupa covered his eyes and groaned, “I’ll have to try again.”

Then Ejupa ran fast as the eagle’s flight to catch the rushing river. The water carried mud and boulders from the dam and cut into the earth as it swept along. Finally the coyote managed to get ahead of the river again. He built another dam. But the water came as it had before and divided into two channels. One made a great waterfall on the north side, and the other a fall on the south side.

Ejupa watched, unable to believe that the river with all his beautiful fish just couldn’t be stopped. “I’ll try another time,” he gasped. “No old river is going to get the better of the great coyote.” And he ran on, making a great dust cloud as he tried to catch the wildly flowing water.

Finally he got ahead again and built the biggest dam of all. He piled great heaps of rocks and soil all the way across the channel. And the river roared into the space behind the dam and made a big lake. But, once again, when the lake filled, the water flowed over the top, making a vast leaping waterfall from which foam and mist rose high into the sky. As the rushing water carried boulders and soil with it, it carved a deep canyon below the dam and raced on toward the west.

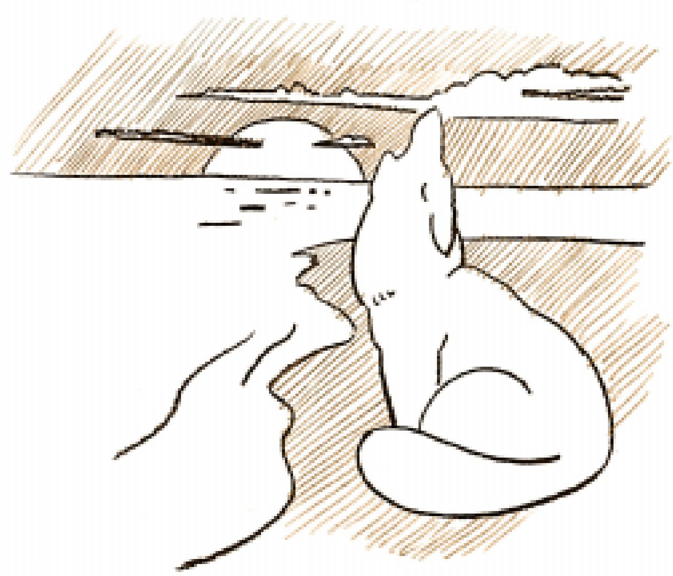
Ejupa almost gave up that time, but decided to run along with the river to watch for some easier place where he might stop it. He trotted far to the west, as the water rolled along beside him, picking up more rocks and sticks. Finally it came to a ridge of high sandy hills.

“Now,” said Ejupa. “At last something will stop that water.”

But he was wrong again, for the river turned, and with its churning water and sharp rocks, it gouged a great canyon far to the north, then turned again west and joined the big river flowing to the sea.

Ejupa trotted home, defeated.

Today the great roaring river and the waterfalls are still there. The river that Ejupa started is the Snake, and the first dam is Idaho Falls. The second dam is American Falls. The third, divided into two parts, is Twin Falls. The last and biggest dam made the highest falls of all, Shoshone Falls. The canyon that the river made when it cut north through the hills of the Seven Devils is called Hell’s Canyon. And all this happened because Ejupa spilled the water from his fish basket. The river connects us to our land and our history and ourselves.



Indian Summer Projects

Like the Snake, the Salmon River has a life of its own. Since 1995, The U.S. Departments of Energy and Naval Research have sponsored the Shoshone-Bannock Tribes with a fish recovery project on streams and tributaries within the Salmon River drainage. The project has focused on assessing stream health, enhancing the climate for egg incubation, restoring stream habitat, and educating the public about the program.

The 1998 projects encompassed 40 stream and tributary sites of the Salmon and Challis National Forests, Sawtooth National Recreation Area, and private lands. It involved 36 teachers and students, 5 staff members, and technical support from the Idaho National Engineering and Environmental Laboratory. With the overall goal of increasing the egg-to-fry hatch rate, the team took over 1 million steelhead eggs from the Pahsimeroi and Sawtooth hatcheries, and placed them in streamside incubators. The team also continued the Purcell Springs Stream Ecosystem Outdoor Classroom project to restore fish and wildlife habitat in the Lemhi area. And for the first time, the team attempted to hatch salmon eggs in a winter project on Cabin Creek near McCall.

Background: Reaching the Home Stream

Salmon Life Cycle

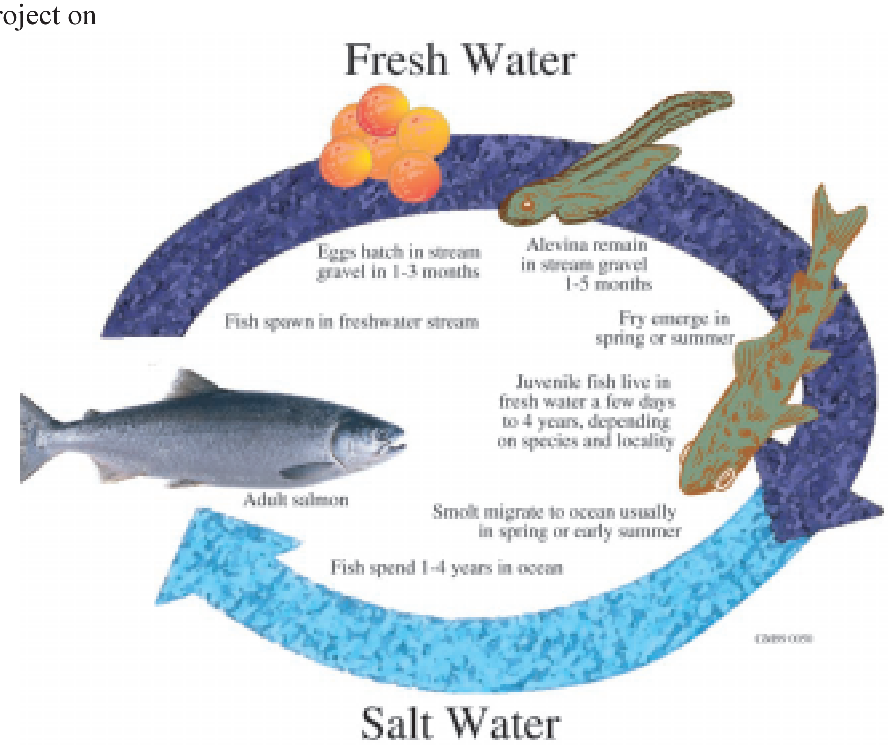
The Columbia River Basin provides habitat for five species of anadromous salmon (Chinook, Coho, Chum, Sockeye and Pink), Steelhead, Shad, and Lamprey. Anadromous salmon hatch in freshwater rivers and tributaries where they live a year or two. They then migrate to and mature in the ocean, and return to their place of origin as adults to spawn.

Factors in Salmon Decline

Reaching the home stream to spawn is a difficult journey for salmon and steelhead. A number of factors have contributed to the decline of the salmon and steelhead stocks in the Columbia and Snake River Basin. Overharvesting in the late 1800s and the early 1900s, effects on habitat from farming, cattle grazing, mining, logging, road construction, and industrial pollution, and the complex of tributary and mainstream dams all have had impact. A variety of ocean conditions including currents, pollution, temperature changes, and nutrient base affect salmon survival. Dams clearly have had a significant impact, particularly those that eliminated access to freshwater habitat (preventing adult fish from returning to spawn), and those through which fish passage is provided but at reduced levels from natural conditions.

Approaches To Preserving Species

Single-species recovery efforts in Idaho have employed various techniques, including captive breeding (peregrine falcons and sockeye salmon), reintroductions (peregrine falcons), population augmentation (woodland caribou) and cross-fostering (whooping crane eggs placed under nesting sandhill cranes). These and all of Idaho's



other Threatened or Endangered species have benefited from education, information, and law enforcement efforts, as well.

The Dance of the Salmon program[1] has taken another approach. We tried to educate young tribal members on preserving habitat as well. The ecosystem approach is much more cost-effective than a single-species approach that may cost hundreds of thousands of dollars, yet guarantees no more success than an ecosystem-based program.

***"One of the natural laws is that you've got to keep things pure. Especially the water. Keeping the water pure is one of the first laws of life. If you destroy the water, you destroy life"* — Oren Lyons Onandaga.**

As you will see, all things are truly related to each other. What we do for one affects many. Indian Summer is much more than science or research working with Native American students. Indian Summer is teaching students to see and listen beyond their own needs, to maintain the balance between receiving and giving back. Indian Summer is about respect. Respect for nature, respect for one's self.

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[1] *The Indian Summer project is part of the Shoshone-Bannock Tribe program called* Dance of the Salmon*, which undertakes environmental studies and encourages tribal students to use their skills to build a better future.*

Life in Camp

J. Francis Rummel summarizes a great deal in one sentence: “Now that we have achieved education for all, let us now seek education for each.”

Indian Summer explores many avenues of learning. Teachers who work predominately with Native Americans need to understand traditional Native views. To foster curiosity, problem solving skills, information gathering skills, and recording techniques is a goal of many teachers for their students. Indian Summer seeks to integrate science with Native American culture in so students may cope with modern living as consumers, producers, and productive members of society.

Learning does not always happen in a classroom. Learning can and does happen EVERYWHERE! In camp, in the Sawtooth mountains, on the streams.

We want to show our students that much learning is done by trial and error. We want to show them that errors are a good way of learning. We also want to be good listeners, both as students and staff members. Communication, real communication, between teacher and student is essential to effective teaching.

Traditionally, Indian people depended on nature to satisfy their needs. They used what was available. They hunted only as much game as they needed. To take more was wasteful of both nature, time, and energy. They worked when there was work to be done and enjoyed relaxation when there was not. People did not work just to be working or to look busy. The puritan work ethic had no place in their culture.

Students are expected to help with the meals in camp. They get water, wood, and sometimes cook for our "Summer Tribe." We all work together.

We have found that much learning can take place in our camp. We take time to give students the value of leisure! We take time to listen to students or hear stories around a campfire. All the goals we discussed earlier can and do happen in camp.

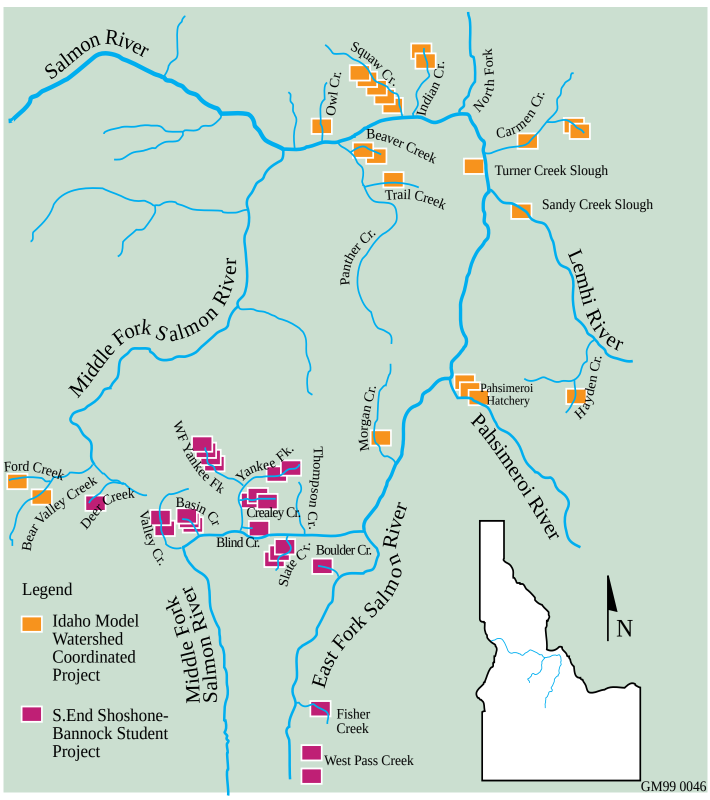
We assure students they can learn to live in the dominant society without rejecting the culture and heritage of their families and the community/tribe.

Camp Directors were Ed Galindo, Ben Rinehart, and Sgt. Moeller.

"The Indian educational enterprise is peculiarly in need of the kind of approach that… is less concerned with a conventional school system and more with the understanding of human beings" **— William Byler, Past Executive Director, Association on American Indian Affairs**

Indian Summer IV: Streamside Egg Incubation Project for 1998

A good way to show students the utility of science is to teach it as a problem-solving activity. At the Shoshone-Bannock High School, we are using the environment as our classroom. Because Mother Earth is our home, what better place to teach the students! Starting with the environment, students can learn the scientific method of making a hypothesis and drawing conclusions from the evidence. As educators, we are building an environment that fosters learning and teaches respect, curiosity, problem-solving skills, information gathering skills, and recording techniques. Students learn that the scientific method is a naturally occurring event; it happens every day in their lives.



We believe that student projects, such as Indian Summer, are a step toward increasing student motivation, participation, and self-esteem. Projects like these encourage students to think independently and to interact confidently in group situations. Much like the struggling salmon and steelhead, Native American students have many hurdles to cross and need a healthy, safe environment in which to grow and thrive. We firmly believe that the Indian Summer projects are reaching these objectives, not for just Native Americans, but for all students.

Project Goals and Scope

The Indian Summer team developed three goals to help increase the hatch rate of salmon and steelhead in Idaho waters:

1. Examine current fish populations and habitat conditions
2. Determine what factors may be affecting fish populations
3. Address the factors limiting fish populations.

The following objectives were formulated to help students reach the goals of the project:

1. Test the technology for successful hatching
2. Increase egg to fry survival
3. Determine optimum incubator densities and configuration
4. Minimize cost
5. Minimize process
6. Minimize handling of fish
7. Test new equipment and designs
8. Increase community education and involvement.

Since the streamside egg incubation project started in 1995, we have expanded from 4 to 40 sites. The 40 project sites are in the Salmon and Challis National Forests; Leadore, North Fork, Challis, Yankee Fork and Salmon/Cobalt districts; Sawtooth National Recreation Area, and extend over 200 miles within the Salmon River Drainage and on private lands. The project was divided into two areas: the north-end sites (downstream from Challis) and the south-end sites (upstream from Challis). The Shoshone-Bannock team coordinated efforts for the south-end sites, and the Idaho Model Watershed Project, Forest Service, and Idaho Fish and Game coordinated efforts for the north-end sites.

Based on the success of the 1995–1997 projects, the students decided to use the same methods in 1998 for the south-end sites. They used a modified incubator box and Whitlock Vibert (WV) boxes to hatch steelhead eggs obtained from the Pahsimeroi and Sawtooth hatcheries.

Ed Galindo, Sho-ban tribes and camp director; Dr Katie Blanding, Director of Office for Naval Research which funded the program; and Ben Rinehart, INEEL mentor and camp director

Technologies Used to Enhance Streamside Egg Incubation

For the south-end sites, a new device was added this year: Global Positioning System (GPS) technology. We used GPS technology to log our sites. The reasoning was two-fold. First, we wanted to see if we could get satellite transmission in our remote mountain sites. We found we could. Second, we also wanted staff and students to be exposed to the use of satellite telemetry. The FCC has approved our use of GPS technology in remote sensoring applications. We are now in the first steps of field testing our equipment. We plan on full field testing in the summer of 1999. We want to use satellite telemetry to gather data remotely from the incubator boxes in the field to our lab computer with an e-mail message. This will greatly enhance our ability to monitor things like dissolved oxygen, water flow, and fish migration. We also want to receive a message in alarm mode if water flow stops or fish are migrating from the box.

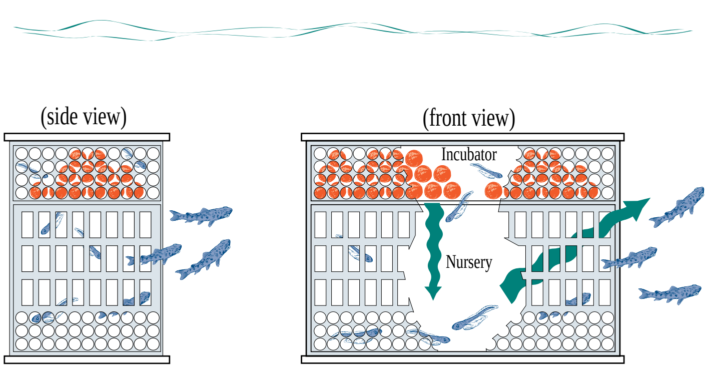
The solar-powered fish data logging device was used to show when the fish moved out of the incubator into the stream. The young fry moved between 11:00 p.m. and 5:00 a.m. This was important because it showed us that the fish were beginning to act like wild fish, even at the fry stage.

The upweller incubator is designed using a 5-gallon bucket, perforated plate, and irrigation diversion screen materials. The objective of the upweller was to see if its use would help solve the sediment problem. It was successful. The sediment settled on the bottom of the bucket, and the clear water remained on top.

For the north-end sites, different types of Washington State remote site incubators, Canadian Jordan/Scotty boxes, and the homemade Crystalex bucket upweller, in addition to the refrigerator incubator with WV boxes, were tested.

Because of a variety of natural conditions and the new devices tested, the south-end live hatch rate was 87.5% as compared to the 90% rate we saw last year. The north-end live hatch rate increased to 75% this year from 62% last year. The increase in the north-end sites' success resulted from not only new devices (Wyoming Refrigerator Units, Bucket Upwellers), but also from additional eggs planted later to replace early losses.

Whitlock Vibert box



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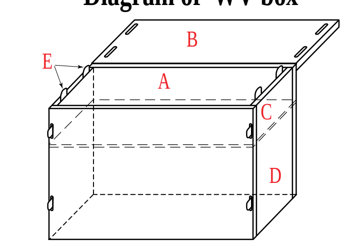
Whitlock Vibert Box and Streamside Incubator

The original Vibert box was developed in France in 1950 by Richard Vibert. The students' Whitlock-Vibert (WV) box is an improved version of the original Vibert box. It is larger than the original and uses modern materials and design, which has improved its function. The box can be used for trout, salmon, and char eggs in any water that supports the species. The WV box is constructed of polypropylene and measures 145 x 90 x 60 mm (6 x 3.5 x 2.5 in.). The sides, top, and bottom have rectangular slots for water circulation, desilting, retaining, and releasing the eggs and fry, and prohibiting predators from entering. The nursery portion of the WV box protects the eggs until they are hatched. After they are hatched, the fry remain protected from predators in the nursery until the yolk sac is absorbed. Then the fry escape through the slots and live in the streamside incubator until they are ready to exit to the stream.

The top lid of the WV box has sixty 3.5 x 13-mm slots for water circulation and swim up fry escape passage. It also restricts predators and works as a desilting mechanism. The flap of the top lid opens into the incubator and has sixty-nine 2 x 2-mm vents also for circulation, ventilation, predator protection, and silt retention. The top compartment can hold one or two layers of approximately 250 salmon eggs or 500 trout eggs. Typically, hatch success in the WV boxes averages from 75 to 95%. Fry that successfully leave the WV box and enter the stream average from 20 to 50% of the original number of eggs.

Diagram of WV box



A. Top lid of incubator
B. Top lid flap
C. Incubator compartment
D. Nursery compartment
E. Tabs for assembly

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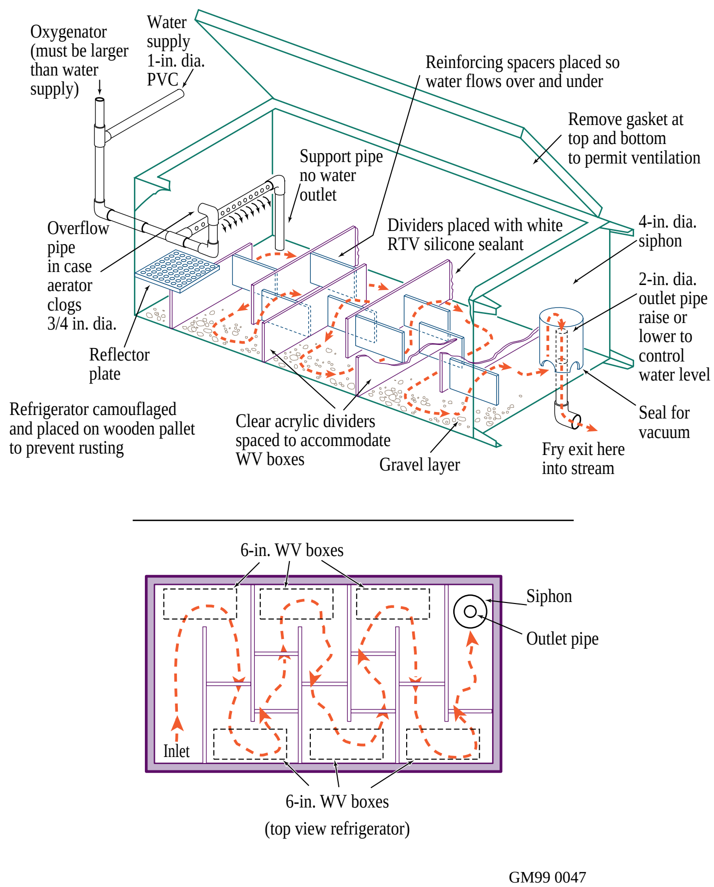
For the streamside incubator, the students modified the interior of an old refrigerator. Acrylic dividers and rocks were placed in the bottom of a refrigerator so water flowing through it created currents similar to a small stream. Water from the stream was supplied using 1-inch diameter polyvinyl chloride (PVC) piping. The students also built an oxygenator and aerator with PVC pipe. A 2-inch diameter outlet pipe was used to control the water level and allow the fry to exit the incubator. The total cost of the converted incubator was $30. The incubator was camouflaged and placed at the side of the stream on a pallet to prevent it from rusting. The WV boxes fit along the sides within the incubator. Anywhere from 20,000 to 40,000 eggs can be grown in the incubator.

Unlike hatcheries, the incubator using the WV boxes allows the eggs to survive in an almost natural environment. Once the eggs are placed in the box, they are not handled again by humans. Much like natural spawning, eggs in the WV boxes are subject to random mortality, which allows the stronger, "smart" fish to develop greater survival skills. The new fry protected in the incubator develop a more advanced yolk sac, producing stronger, mature fry, that after leaving the box, have a better chance of survival from natural losses.

Trout Streamside Incubator

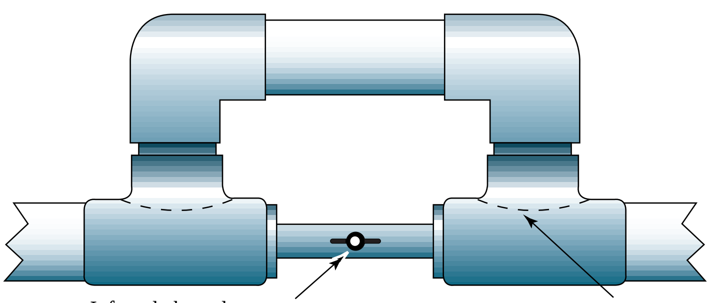


Fish Data Logging Device

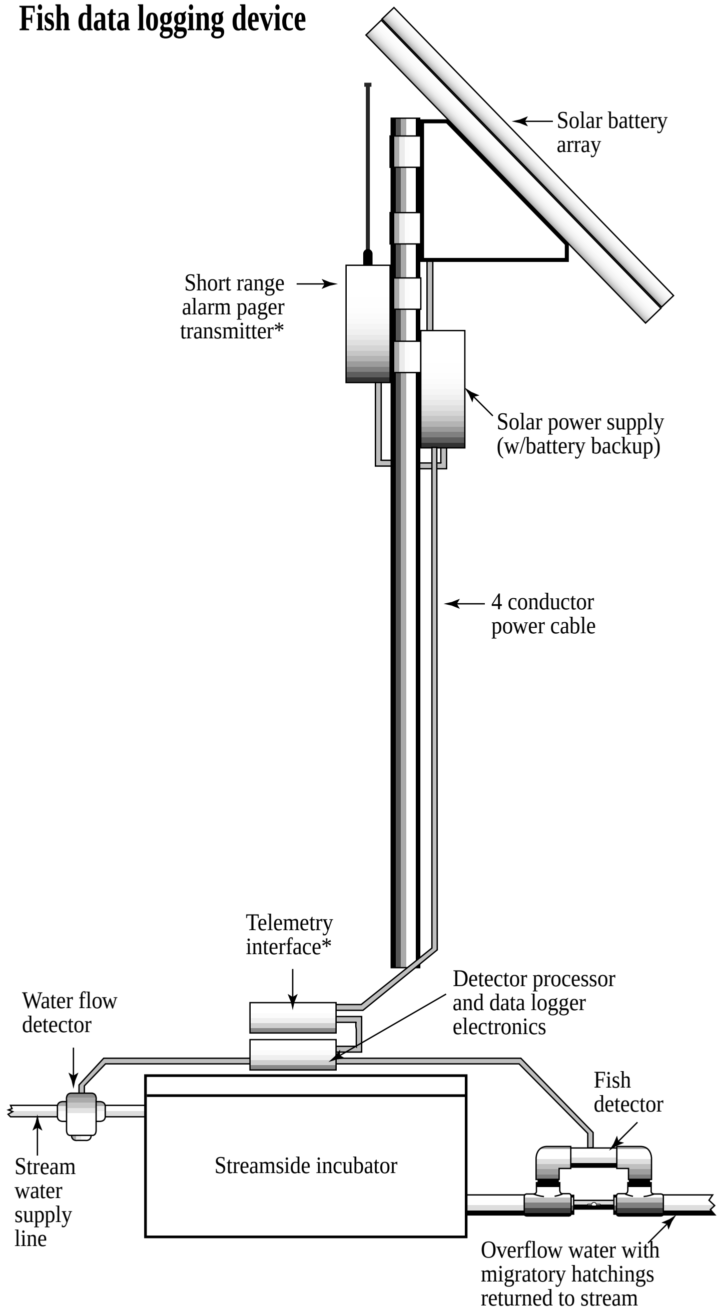
The fish detector shown is a model of a fish detector built and field tested by the Indian Summer project team. This detector monitors and logs any fish leaving the incubator, allowing data to be collected on the migration habits of newly hatched fish.

A narrow channel houses an infrared emitter and detector to detect passing fish, and a bypass channel carries any hatchery outflow not able to pass through the detector channel. Fish are prevented from traveling through the bypass channel by a screen placed in the inlet and outlet of the device.

Fish detector



Fish data logging device



* Items marked are optional system elements

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The detector is assembled with standard irrigation-type PVC fittings and pipe. The box mounted at the top is the junction box in which wires from the emitter and detector are spliced to a single shielded cable that runs to the logger apparatus. This particular unit is fitted with a calibration pot and jack to make setting up the monitor in differing light easier.

The detector channel is constructed from 3/4-inch PVC pipe and fitted to the rest of the detector with two PVC reduction fittings. The channel is painted black on the outside so no light will enter the channel around the sensors. An infrared emitter and detector are inserted into the channel through two small holes drilled opposite of each other in the PVC pipe. Tightly twisted lead wires run to the junction box at the top of the assembly. When operating, the infrared detector is illuminated by the emitter and biased just beyond the switch-on point.

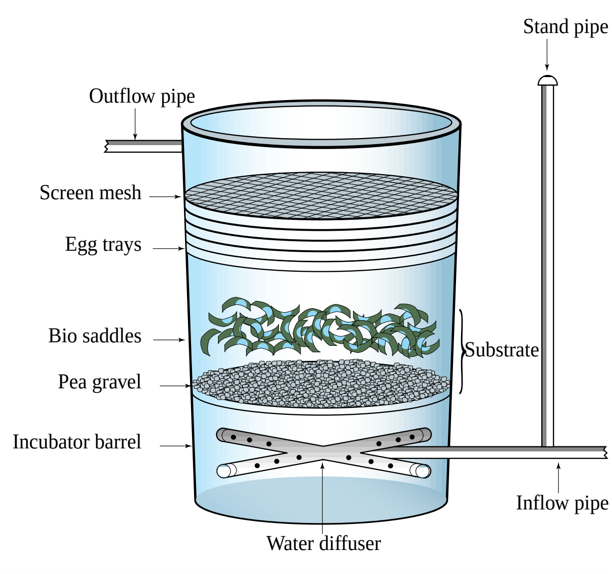
Anything interposing itself between the emitter and detector will cause the detector to switch off, signaling a smolt in the fish gate. A single infrared detector pair covering the middle of the channel seems to detect the migration of fish satisfactorily. The unit does not count fish, but measures migration patterns, and it seems well suited to this use.

Using this detector, we found that large numbers of fish departed at about the same time of day (11:00 p.m. through 5:00 a.m.). The fry left the hatch box at night, when it was cool and they were less susceptible to predators. This was the best time for them to survive on their own.

Upweller Design

Upweller incubator devices were evaluated at the north and south-end sites. The upweller uses a 5 to 10-gallon plastic bucket or a 50-gallon barrel with a lid. The buckets have inlet and outlet pipes to allow the water to run through. Inside the bucket, there is a water diffuser, filter screens, substrate, and up to 5 egg trays. As the water flows through the bucket, the bottom filter screen keeps sediment and leaves from settling in the egg trays. The plastic egg trays hold the eggs until they hatch. Once the eggs hatch into fry, they drop through 1/4 x 1/2-inch slots in the trays to the artificial substrate layer, which are plastic fortune cookie-shaped pieces, in the middle of the bucket. The substrate keeps the fry above the sediment that has settled in the bottom of the bucket. At the bottom of the bucket, there is another filter screen with a 1/4-inch

Upweller device



layer of pea gravel that keeps the bottom layer of sediment from the fry. The fry exit the bucket through the outlet pipe to enter the stream. Homemade versions of the concept were made using Crystalex buckets.

Table 1 shows the life history survival rate for three steelhead production strategies: hatchery, wild, and incubator. The difference between the hatchery and incubator in the number of adults produced is minimal; however, the difference in production cost is large—the hatchery is more expensive than the incubator.

Assessing Fish Habitat and Stream Conditions

Physical and chemical stream conditions are important in producing salmon and trout. Temperature, water clarity, flow, and oxygen contribute to healthy streams.

To learn to effectively manage and enhance fish populations, the students gathered basic physical and biological data. With the help of community mentors, they analyzed the data to determine population status and factors limiting fish production.

The students conducted five streamside tests: (1) temperature, (2) nitrate (NO_3), (3) dissolved oxygen (DO), (4) millimeter (mm) size of the eggs and fry, and (5) pH readings in the boxes and stream. The boxes were monitored daily for 10 days and then weekly for 60 days. A summary of the results follows.

Temperature

Temperature was measured to see if the hatch boxes would hold temperature consistently. We found that they did, with temperatures ranging from 4.5°C (Valley Creek) to 10°C (Upper West Pass Creek). The temperatures remained consistent every day during the project time (62 days).

Table 1. *Expected life history survival for three production strategies. Starts with 40 steelhead (20 males, 20 females); progression from left to right.*

Strategy	Eggs	Survival rate (%)	Eyed eggs	Survival rate (%)	Fry	Survival rate (%)	Smolt	Survival rate (%)	Adults
Hatchery	100,000	95	95,000	95	90,250	95	85,750	3/10	258
Wild	100,000	—	—	10	10,000	38	3,800	6/10	23
Incubator	100,000	95	95,000	95	90,250	38	34,300	6/10	206

We had extremes in outside air temperatures from 13.7°C at Basin Creek #1 to 26°C at Basin Creek #2.

Nitrate

(NO_3) was measured to indicate (1) possible pollution in the streams and (2) pollution of fry in the hatch boxes. We wanted to know if the longer the fry spent in the boxes, would they make a greater concentration of their own pollution, and if those concentrations were toxic to the fry. We found that all the boxes were at 0 mg/liter.

Dissolved Oxygen

DO was monitored to make sure the eggs had enough oxygen to sustain life. The range was high as one would expect in a mountain stream. We were interested in knowing if levels of DO would drop in our incubators as time went on. They stayed the same. Ranges were from 7.75 to 10 mg/liter (Valley Creek to West Fork Yankee Fork).

Egg Size

The egg size was used to monitor growth of the fry. We were interested in knowing if their size continued to increase once the eggs were in the hatch boxes. Remember, we do not feed the fry once they are in the boxes. We noted good growth during the project time (62 days). Ranges were from 10 mm (6/10/98) to 30 mm (8/10/98).

Acid or Base of the Stream

The pH of the stream is important to the well being of fry. We were interested in knowing if the pH of the fry in the boxes would change as a result of their environment. We saw no change in stream versus the boxes. The range was 7 to 8 in all boxes.

Summary of Data

Table 2 summarizes the results of the streamside incubator project. The high school students gathered the data for the south-end sites. This area is located below the Galena Summit to the White Clouds area (East Fork of the Salmon River). The students had 548,760 eggs with a 87.5% hatch rate. The north end consisted of the lower Salmon River country, mainly from the Middle Fork to Challis and was jointly carried out by private landowners, Idaho Model Watershed Project, Idaho Fish and Game, and the Salmon and Challis National Forest staff. The north-end sites had 501,450 eggs with a 75% hatch rate. The map on page 8 shows the hatch box locations.

Table 2. *Hatch rates for 1998 Streamside egg incubation project.*

Area	*Box No.*	*No. eggs*	*No. live fry*	*Hatch rate (%)*	*Comments*
North-end Sites					
Owl Creek	1	57,800	40,530	70	"Hot eggs," hatching during planting, high mortality due to handling
Boulder Creek	1 & 2	39,500	27,880	71	Hatching in progress, poured loose
Squaw Creek Spring		97,050	85,550	88	Upwellers had better flow without smothering eggs; some "hot eggs" hatched during planting
Indian Creek Spring		64,600	54,360	84	Loss of flow;"hot eggs" hatched during planting;
Carmen Creek		32,400	23,010	71	Some "hot eggs" hatched during planting
Freemen Creek		35,000	27,090	77	"Hot eggs" hatched during planting;
Turner Slough		12,100	3,600	30	"Hot eggs" hatched during planting; warmer temps resulted in mold
Morgan Creek		30,000	29,700	99	Late plant to avoid high runoff problems
Ford Creek		40,000	15,000	38	95% hatchout, but lost fry due to cloudburst and loss of flow due to plugged waterline
Deer Creek		20,000	10,000	50	Sedimentation and loss of flow
Upper Bear Valley Creek Springs		58,000	46,400	80	Outstanding site; 99% hatch, but flow loss resulted in loss of fry
Middle Bear Valley Creek		15,000	13,500	90	
Live hatch rate, north-end sites		**501,450**	**376,620**	**75%**	
South-end Sites					
Boulder Creek	1	26,160	24,797	94.78	
Boulder Creek	2	26,000	25,461	97.92	
Valley Creek	1	33,000	24,800	75.1	
Valley Creek	2	20,000	17,387	86.9	
Basin Creek	1	30,000	29,417	98.05	
Basin Creek	2	20,000	19,359	96.8	
Basin Creek	3	30,000	29.069	96.9	
Crealey Creek	1	30,000	29,734	99.13	
Crealey Creek	2	40,000	39,110	97	
Slate Creek	1	30,000	29,690	98.9	
Slate Creek	2	30,000	29,940	99.8	
Slate Creek	3	20,000	19,679	99.1	
Fisher Creek	1	35,000	22,500	64.3	
Blind Creek	1	20,000	18,528	92.6	
Lower West Pass Creek	1	25,000	23,184	92.7	
Upper West Pass Creek	2	28,000	23,670	84.5	
West Fork Yankee Fork	1	20,000	19,133	95.7	
West Fork Yankee Fork	2	34,000	33,187	97.5	
West Fork Yankee Fork	3	31,600	31,493	99.7	
West Fork Yankee Fork	4	20,000	19,033	95.1	
Live hatch rate, south-end sites		**548,760**	**480,131**	**87.5%**	
Totals (North and South End)		**1,050,210**	**856,751**	**81.5%**	

Indian Summer IV: Winter Study

In the fall of 1997, Shoshone-Bannock students and mentors placed about 50,000 Chinook eggs in streams in the remote central mountains of Idaho, near the town of McCall. We used knowledge of the streamside incubator to monitor eggs. The study was terminated in late December as winter conditions were killing the fish. Streamside boxes were emptied into the streams as boxes were freezing solid. Our losses were heavy. However, we learned a great deal. We have since rethought our winter strategy, and we now place Chinook eggs directly in the streams using Jordy boxes instead of incubators. Also, we use springs whenever we can, as they keep a constant temperature year-round. Our spring called Cabin Creek reported the following results.

Table 3. Cabin Creek winter study results

Factor	*Measurement*
Air temp	6.31°C
Box temp	4.91°C
Source temp	3.14°C
pH	7.47
Dissolved O2	9 mg/L
Nitrate	0 mg/L
Eggs place in box	15,000
eggs hatched	14,800
Live hatch rate	98.6%

Indian Summer IV: Purcell Springs Stream Ecosystem Outdoor Classroom

Shoshone-Bannock High School also monitored our shared, outdoor classroom in the Lemhi area. Last year we built island frames to improve habitat. This year we were happy to find an abundance of growth, with ducks making nests on some of the Islands. What a difference a year makes!

Our thesis here was to improve habitat, and work with Leadore High School on a joint project of habitat restoration. Next year we plan to do a joint fencing project on site. Meanwhile we continue to monitor the recovery effort.

***"As you can see, the traditional thinking of the American Indians is a major factor in the way they think about saving the salmon. Their desire to maintain a salmon population that is viable protects their immediate needs, and also the needs of the future, American Indian or not"* — Ted Strong, Columbia River Intertribal Fish Commission**

1997

1998

Evaluation of Program

It is a great honor to work with the youth of two tribes: fish and students. Change takes place over the summer for both tribes. Change must come from within, and change takes time. Achievement for the fish and students means the same thing. Achievement is accomplishment through ability, effort, and courage. Achievement is creative contribution and giving. The Indian Summer students are achievers. They are working for the good of the fry and to help themselves. In return, they are giving back to society by surviving, making a good life, taking care of family, and being lifelong learners. They are learning to give, and this is what is important.

"Legacy of the Salmon, survival of the Salmon, has always meant more than just food for the Indian People. Indians have long recognized that if they are to survive and if their children's children are to survive it will be because the Salmon Survives. It is their legacy" **— Bill Frank, Jr.**

The question is asked, Is this program working? I would say yes! As an educator, we have hands-on learning in the greatest classroom ever, nature. Specifically, we have seen at least two benefits.

First, I have students go on to college this year to study wildlife management. I would like to think Indian Summer had some influence on that decision. Other students are employed by the tribe as technicians in the fishery department. Some are struggling just like the young fish they are working with.

Second, for the first time we have seen fish in streams where our incubators have been. We feel these could be our fish, as they are not marked. We will see if more show up in the following years.

I feel that we are truly related to each other. What happens to one affect the many.

Acknowledgments

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As the fourth year of Indian Summer draws to a close, we would like to extend our appreciation to the people and organizations who helped make the project a reality for the students.

Ed Galindo—As a Native American science teacher at the Shoshone-Bannock Junior/Senior High School, Ed continues to provide his students with the resources, enthusiasm, and care that all young people need and deserve. Ed's commitment to his profession and to his students is rewarded each year when his students graduate and begin to work toward their goals.

Ben Rinehart—With DOE's Hydropower Program for 18 years, Ben is a science and engineering mentor through the INEEL. In support of the TRAC educational programs, Ben provides technical advice, resources, and yearly support to the Indian Summer projects.

Julene Messick, INEEL Institute—Thanks to Julene's hard work, students and teachers from outside Fort Hall Reservation were able to participate in the Indian Summer experience this year.

Dirk Kempthorne—Senator Kempthorne (now Governor of Idaho) made a substantial contribution to the project this year by sponsoring legislation to make Basin Creek a free area where no activities, such as mining, can take place. This allows the creek to return to a natural state that will enhance salmon and trout spawning areas and assist in their recovery.

U.S. Army—SFC John Moeller.

J. R. Simplot—Gerald McNabb and his staff analyzed our samples for mercury, lead, and arsenic, among others. We appreciate their time and effort to help us determine what the samples contained.

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Idaho Rivers Unlimited—This organization provides us with a voice in the public sector. They have been instrumental in spreading the word of our achievements with the steelhead eggs.

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Ben Rinehart, Idaho National Engineering and Environmental Laboratory, P.O. Box 1625, Idaho Falls, Idaho, 83415-3830, (208) 526-1002.

Streamside Incubator Designs

Refrigerator Incubator Design, Flaming Gorge/Lower Green River Chapter, Wyoming Trout Unlimited, Bone Draw Project. Contact Dr. Fred Eales (307) 382-4857.

Washington State Remote Site Incubators (Upweller Design). Contact Jerry Manuel (360) 427-2161.

Jordan/Scotty Boxes, B.C. Canada. Contact Blaney Scott (250) 382-0141.

Whitlock Vibert Boxes, Federation of Fly Fishers. Contact Evelyn Taylor (406) 585-7592.

Indian Summer IV

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